

# Final Assessment Report

## Computing and Financial Management (BCFM)

### February 2024

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#### Executive Summary

External reviewers found that the Computing and Financial Management program (BCFM) delivered jointly by the David R Cheriton School of Computer Science and School of Accounting and Finance was in good standing.

“We were impressed by the academic quality and practical relevance of the program. In our opinion the program is rigorous and covers both breadth (Finance and CS) and depth.”

A total of four recommendations were provided by the reviewers, regarding advising, course offerings, faculty appointment, and building relationships. In response, the program created a plan outlining the specific actions proposed to address each recommendation as well as a timeline for implementation. The next cyclical review for this program is scheduled for 2027-2028.

#### Enrollment over the past three years

	<b>BCFM</b>
2023-2024 (CURRENT YR)	204
2022-2023 (LAST YR)	187
2021-2022 (THREE YRS)	206

\*Based on Active Student Extract from Quest on February 1, 2024.

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#### Background

In accordance with the University of Waterloo’s Institutional Quality Assurance Process (IQAP), this final assessment report provides a synthesis of the external evaluation and the internal response of the Computing and Financial Management program (BCFM) delivered jointly by the David R Cheriton School of Computer Science and School of Accounting and Finance. A self-study (Volume I, II, III) was submitted to the Associate Vice-President, Academic on April 4, 2023. The self-study (Volume I) presented the program descriptions and learning outcomes, an analytical assessment of the programs, including the data collected from a student survey, along with the standard data package prepared by the Office of Institutional Analysis & Planning (IAP). The CVs for each faculty member with a key role in the delivery of the program(s) were included in Volume II of the self-study.

From Volume III, two arm's-length external reviewers were selected by the Associate Vice-President, Academic: Dr. Tony Ware, Professor of Applied Mathematics, University of Calgary; and Dr. Matt Davison, Professor of Statistical and Actuarial Science, Western University.

Reviewers appraised the self-study documentation and conducted a site visit to the University on October 16-20, 2023. An internal reviewer from the University of Waterloo, Dr. Mike Stone, Professor of Geography, was selected to accompany the external reviewers. The visit included interviews with the Vice-President, Academic & Provost; Associate Vice-President, Academic; Deans of the Faculties of Mathematics and Arts; Faculty Associate Deans of Undergraduate Studies for the Faculties of Mathematics and Arts; Co-Directors of the Department, as well as faculty members, staff, and current undergraduate students. The Review Team also had an opportunity to meet with representatives from the library, and Co-operative Education.

Following the site visit, the external reviewers submitted a report on their findings, with recommendations. Subsequently, the program responded to each recommendation and outlined a plan for implementation of the recommendations. Finally, the Dean responded to the external reviewers' recommendations, and endorsed the plans outlined by the program.

This final assessment report is based on information extracted, in many cases verbatim, from the self-study, the external reviewers' report, the program response and the Dean's response.

### **Program Characteristics**

The CFM program offers a unique study experience for students as it is the only program in Canada to combine two majors in finance and computer science into one degree. It is also the only program to combine these two studies with a mandatory co-op program, requiring at least five four-month work terms.

CFM is a co-op only program, which provides students with the opportunity to gain up to two years of professional experience over five to six four-month work terms. The program was designed with co-op education as part of its degree requirements and students must complete their co-op work terms in order to graduate.

Students may choose after graduation to pursue designations including a Chartered Financial Analyst (CFA), Information Systems Professional (ISP), and/or Information Technology Certified Professional (ITCP) designation because of the accreditations that the CFM program has received from Canada's Association of I.T. Professionals and the CFA Institute. Graduates may also pursue graduate studies in the fields of computer science, finance or both.

## Summary of Strengths, Challenges and Weaknesses based on Self-Study

### Strengths

- Growing number of applicants.
- Growing number of alumni with relevant career outcomes.
- Program prepares job-ready students for financial technology (fintech) roles.
- Unique program and degree (BCFM).
- Career growth in the FinTech industry.
- Mentorship program to support students.
- Tight-knit community.
- Dedicated support of a Program Manager.

### Challenges

- The population of Ontario Secondary School (OSS) applicants is declining.
- New program competitors may arise.
- A decline in applicants will result in the loss of funding for the program.
- High admissions average for a niche program.
- Limited degree recognition by employers.
- The David R. Cheriton School of Computer Science, the School of Accounting and Finance, the Faculty of Mathematics, and the Faculty of Arts, do not keep sophisticated or easy-to-interpret records of retention to compare with CFM's attrition numbers.

### Weaknesses

- Limited course flexibility.
- Program demands strong time management.
- High tuition costs.
- High attrition rate.
- Limited engagement with alumni.
- Employers are not familiar with CFM.
- Limited scholarships for future and current students.

### **Summary of Key Findings from the External Reviewers**

“We thought the new CFM courses, two of which (CFM101 and 301) have already been offered, are really good. It would be great to consider replacing one of the “deep computer science” courses on the CS side with a custom-made CFM course devised and taught by School of CS faculty. It is possible that a slight decrease in the number of required courses might be considered, to free space for more electives (even within program relevant ‘pick lists’), available to program students.

We were impressed by the students we met and their positive commentary on their program. We were also impressed by the strong quantitative and qualitative metrics shared with us by the co-op office in terms of how well the students were doing on their placements and where those placements were.”

### **Program Response to External Reviewers’ Recommendations**

1. Adjust details around the program advisor role to improve links with other counselling staff and to, if possible, improve the position salary grade to increase long term retention of staff in this role and to better support the program advisor in all aspects of the role.

#### **Program Response**

This has been our greatest concern in the program, and so having it as the first recommendation fits very well with what we also view as a major shortcoming in the program. The co-Directors have reached out to Breean Belton (SAF staff member and supervisor of the CFM manager position) and Tracey Williams (Administrative Officer of SAF) to express our desire to address this recommendation fully and completely. We are pleased that the initial response has been positive, which we detail below from Breean Belton.

“In the coming months we are hoping to build more cross training among the group of advisors in AFM, SFM, and CFM. This team is currently made up of 3-4 AFM advisors, the SFM Program Manager, and the CFM Program Manager.

Some of the strategy behind moving the SFM and CFM Program Managers into this team was so that we could leverage all SAF advisors to support all programs. The plan would be to build in cross training so that advisors can help each other during peak times or when someone is away. The intention is to provide more support to our students and to the advisors.

In addition to building cross training into the team, other ideas we’d like to explore are:

- Review the CFM Program Manager position (workload and responsibilities).

- Consider hiring a permanent staff advisor or coordinator position that would work directly with the CFM Program Manager. This would likely be instead of a temporary co-op position each term. This would provide additional support to students, knowledge sharing, cross training, and capacity for the Program Manager to be more involved in other areas (strategy, planning, director support, alumni relations).
- Consider having the CFM and SFM Program Managers collaborate closely to share best practices, share common resources and investigate cross-training.

Also of note, we recently added a new position in SAF for events. The Events Manager helps support the logistics of event planning. The CFM Manager can seek support for events from this position.”

#### **Dean’s Response – Arts**

The Dean supports most of the responses to this recommendation, particularly cross-training for advisors and the review of the Program Manager and enhancing collaboration between the CFM and SFM Program Managers. Like Math, I do not think that an additional permanent dedicated CFM advisor/coordinator is warranted.

#### **Dean’s Response – Math**

Increasing integration and collaboration between the CFM Program Manager and advisors in SAF, CS and Math more generally is an important step in providing good guidance and a strong student experience. I am supportive of an increase in grade, consistent with similar positions, especially in other VPA programs. It is unlikely at the current scale of the programme that an additional permanent CFM-focused staff advisor is appropriate, and we’d be better served by more capacity and integration in the constituent units (CS, Math and SAF).

2. Continue path to offering one or more additional CFM coded courses, including one which replaces a more detailed CS program course in the curriculum with a financially relevant computer science course. Consider reducing the number of required courses in order to allow for more electives, even if from pick lists, so as to allow students to develop their own interests. We feel it is important for each CFM graduate to be able to do graduate school in one of CS or Finance if they wish and plan toward it, but that it might not be reasonable to ensure that every graduate be prepared to do graduate work in both disciplines.

#### **Program Response**

The CFM Program is pleased that the external reviewers acknowledged the importance and quality of the newly created CFM courses (CFM 101, 301 and 401). This initiative was originated from SAF, and the intention was to teach the CFM students right from the beginning what this program is about and how computing and finance work together. The

recommendation of offering additional CFM courses and in particular, a financially relevant computer science course, aligns with the general direction of the initiative. Ideally, we would like a course that is of general interest to CS majors and in the meantime of direct relevance to CFM. One potential candidate is CS 476: Numerical Computation for Financial Modeling. It was designed and taught by faculty in the Scientific Computing group in CS. The course is offered for CS majors and it is currently listed as an elective for CFM. In consultation with the Scientific Computing group, we will review and investigate the suitability of revising CS 476 as a required course for CFM with a CFM label. We will also investigate the possibility of creating a brand-new course in other finance-related areas.

The recommendation of reducing the number of required courses is an interesting idea. It provides more flexibility to CFM students and it may help address the issue of retention. However, we also recognize the importance of a well-balanced program with sufficient foundational and advanced knowledge in both fields of computer science and finance. In view of this, we are keen on a gradual plan that slowly reduces the number of required courses. We will investigate the viability of allowing a difference of one to two required courses in either field, and then review in the next couple of years whether to proceed further.

#### **Dean's Response – Arts**

The Dean endorses the thoughtful response to this recommendation provided by the program leadership. The Dean of Arts respects the views of the Dean of Math on these questions as well.

#### **Dean's Response – Math**

As noted in the Program Response, CFM is already creating a number of CFM-labeled courses which we hope will serve the program well. Expansion beyond this comes at the danger of boutique courses to small numbers for which there is little capacity to deliver or maintain. The proposed revision of the more broadly accessible CS476 (also to CS, SAS and Math students at least) is a good path forward, but too few CFM students currently take the prerequisite CS370/371/AM241 (which is itself problematic). A revision of CS335 (Computational Methods in Business and Finance) would be another option. It is not clear that a relabeling of these courses as CFM courses is necessary or desirable.

3. Ensure continuity of intellectual leadership in the program in the face of faculty retirements in SAF and CS, by appropriate recruitment. This might include joint appointment of faculty across relevant units including but not necessarily limited to SAF and CS.

#### **Program Response**

The CFM Program agrees with the external reviewers the importance of ensuring continuity of intellectual leadership. Three of the faculty members who have been heavily involved

with the creation, administration, and teaching of the CFM program, have been and will be retired. New faculty appointments are crucial to maintain a healthy offering of the program. That being said, we recognize the challenges of hiring faculty with background in computing and finance. These candidates are highly sought in the financial industry with much higher pay than in academia.

We will consider two directions of recruitment. One is to hire a regular faculty, possibly in the rank of lecturer, for teaching finance-related courses. In particular, we will investigate such a position based in SAF which tends to offer a higher and more competitive salary. In addition, they often possess industrial experience that is of great value to our students.

The other direction is to hire a regular faculty in CS. As the computational finance faculty members in the Scientific Computing group are retiring over the years, there are interests in hiring replacements. A note of interest is that the Faculty of Mathematics is undergoing a new change in organizational structure for managing business related programs. There may be interest within Math to hire a CS faculty to support broadly the developments of business/finance programs.

#### **Dean's Response – Arts**

The Dean of Arts endorses the response to this recommendation by the Dean of Math, and encourages collaboration and realistic assessment of the needs of the program. I add that if a new “lecturer” position is intended to be permanent, then we would be looking at hiring a teaching stream professor (under the new Policy 76) rather than a lecturer.

#### **Dean's Response – Math**

A Lecturer in CS with ability to teach computational finance (perhaps along with Scientific Computing) would be an asset, and one was recently recruited but unfortunately departed soon afterwards. It is not clear this is the best long-term strategy as there needs to be considerable development of senior courses, which is best done by faculty with a research interest in the area. As noted, there is considerable depth in computational and mathematical finance in the Department of Statistics and Actuarial Science. The related and much larger Financial Analysis and Risk Management, Actuarial Science, and Mathematics of Business programs are now all under SAS. We should explore better collaboration in the CFM program development and course development (as well as research).

4. Better leveraging of UW or Faculty-level Alumni Relations teams to keep in touch with students post-graduation. This will be beneficial for CO-OP and post-graduation job placement and for better understanding industry trends and needs for continuous program improvement.

#### **Program Response**

With the first graduating class in 2011, we agree that our program is now in a position where we must do more to facilitate connections with our alumni. The Co-Directors will pursue this from both the University and Faculty of Math level. In addition, on the SAF side, we are working to get the SAF Associate Director of Advancement to have CFM alumni relations within that job description as well.

**Dean's Response – Arts**

The Dean of Arts endorses the program's response to this recommendation.

**Dean's Response – Math**

Advancement is done at a faculty level in Math, including tracking CFM alumni. There could be stronger collaboration with SAF in this regard, much as there is on other VPA programs (e.g. Software Engineering between Math and Engineering).

**Recommendations Not Selected for Implementation**

Not Applicable



**Implementation Plan**

	<b>Recommendations</b>	<b>Proposed Actions</b>	<b>Responsibility for Leading and Resourcing (if applicable) the Actions</b>	<b>Timeline for addressing Recommendations</b>
1.	Adjust details around the program advisor role to improve links with other counselling staff and to, if possible, improve the position salary grade to increase long term retention of staff in this role and to better support the program advisor in all aspects of the role.	Co-Directors to work directly with relevant staff to restructure role and salary of CFM program manager.	This will be a joint effort between the co-Directors, Breean Belton (Supervisor, CFM Manager), and Tracy Williams (Administrative Officer, SAF). There will be resources required to implement changes, these resources will need to come from both the Faculty of Math and the Faculty of Arts.	1-2 years.
2.	Continue path to offering one or more additional CFM coded courses, including one which replaces a more detailed CS program course in the curriculum with a financially relevant computer science course. Consider reducing the number of required courses in order to allow for more electives, even if from pick lists, so as to allow students to develop their own interests. We feel	In consultation with the Scientific Computing group in CS, review and study the feasibility of revising the contents of CS 476 to make it a required course for CFM. New course topics will also be considered.  Review the current curriculum of the CFM program. Investigate the feasibility of reducing the list of required courses while maintaining a healthy balance of computer science and finance.	It will be led by the CFM Program Manager and the co-Directors. It will involve faculty in the Scientific Computing group in CS. No immediate resources will be needed.	1 year.

	it is important for each CFM graduate to be able to do graduate school in one of CS or Finance if they wish and plan toward it, but that it might not be reasonable to ensure that every graduate be prepared to do graduate work in both disciplines.			
3.	Ensure continuity of intellectual leadership in the program in the face of faculty retirements in SAF and CS, by appropriate recruitment. This might include joint appointment of faculty across relevant units including but not necessarily limited to SAF and CS.	Investigate the possibility of a lecturer position in SAF that is able to teach CFM related courses. Also investigate the possibility of a faculty position in CS or Math Faculty that has a background in computer science and finance.	It will be led by the CFM co-Directors. It will involve discussion with administrators at the departmental and Faculty level. The outcome may require resources for faculty positions.	1-2 years.
4.	Better leveraging of UW or Faculty-level Alumni Relations teams to keep in touch with students post graduation. This will be beneficial for CO-OP and post graduation job placement and for better understanding industry trends and needs for continuous program improvement.	Co-Directors to work with alumni relations at the University level, the Faculty of Math, and the School of Accounting and Finance.	This will be lead by the CFM manager and co-Directors. We do not anticipate additional resources required.	1-2 years.

The Department Chair/Director, in consultation with the Dean of the Faculty shall be responsible for the Implementation Plan.

Date of next program review \_\_\_\_\_ **2027-2028** \_\_\_\_\_  
Date


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### Signatures of Approval

*James R. Thompson*      *George Labahn*      April 17, 2024  
\_\_\_\_\_  
Chair/Director      Date

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AFIW Administrative Dean/Head (*For AFIW programs only*)      Date

      Mark Giesbecht      19 April 2024  
\_\_\_\_\_  
Faculty Dean      Date

**Note:** AFIW programs fall under the Faculty of ARTS; however, the Dean does not have fiscal control nor authority over staffing and administration of the program.

*Dan DeVidi*  
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Associate Vice-President, Academic      April 10, 2024  
(For undergraduate and augmented programs)      Date